

Attorney Docket No. 83134
Customer No. 23523

DEVICE AND METHOD FOR PREVENTING
SUPERHEATING OF LIQUIDS IN A MICROWAVE OVEN

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT ANTHONY A. RUFFA, citizen of the United States of America, employee of the United States Government and resident of Hope Valley, County of Washington, State of Rhode Island has invented certain new and useful improvements entitles as set forth above of which the following is a specification:

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3 DEVICE AND METHOD FOR PREVENTING
4 SUPERHEATING OF LIQUIDS IN A MICROWAVE OVEN

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6 STATEMENT OF GOVERNMENT INTEREST

7 The invention described herein may be manufactured and used
8 by or for the Government of the United States of America for
9 governmental purposes without the payment of any royalties
10 thereon or therefore.

11
12 BACKGROUND OF THE INVENTION

13 (1) Field Of The Invention

14 The present invention relates to microwave ovens, and in
15 particular relates to a device and method of use to prevent
16 superheating of liquid during heating within the microwave oven.

17 (2) Description of The Prior Art

18 Microwave ovens are commonly used to heat foods, beverages,
19 and the like by people of all ages and intelligences. Unknown to
20 the general public, heating liquids in a microwave oven can
21 create a very dangerous condition. For example, if the water
22 contained in a new or very smooth cup or bowl (e.g., one that
23 does not have any scratches to initiate boiling) is brought to a

1 temperature of 100°C or greater in a microwave, it can be brought
2 to a superheated (metastable) state.

3 Superheating takes place when a substance is heated above
4 the temperature at which a change of state would ordinarily take
5 place without such a change of state occurring, for example, the
6 heating of a liquid above its boiling point without boiling
7 taking place. When this superheated state is disturbed, a large
8 amount of water can vaporize at once, causing the liquid to
9 "explode" into the face of the person taking the cup or bowl out
10 of the microwave resulting in first and second degree burns to
11 the person.

12 Burn injuries from microwave use are not uncommon and are
13 familiar to emergency room physicians. Presently, microwaves
14 have no apparent indications to warn a person that a liquid is
15 in a superheated condition. While precautions exist that can be
16 taken to avoid creating a superheated condition, these
17 precautions (and the condition itself) are not well known by the
18 general public.

19 In view of the above, it is therefore desirable to have a
20 device that reduces the likelihood of liquid superheating while
21 being easy to use by the general public.

SUMMARY OF THE INVENTION

1 Accordingly, it is a general purpose and primary object of
2 the present invention to provide a device that reduces the
3 likelihood of liquid superheating.

4 It is a further object of the present invention to provide
5 a device adaptable for a microwave oven and easy to use by the
6 general public.

7 A safety device according to the present invention includes
8 a transducer disposed on a support surface. The support surface
9 is adapted to support a container containing a liquid within a
10 microwave oven. The transducer prevents the liquid from
11 becoming superheated by vibrating the support surface such that
12 the liquid within the container nucleates, thus allowing the
13 liquid to boil.

14 In a preferred embodiment, the transducer is embedded
15 within or secured to the support surface. Alternatively, the
16 support surface may be either an integral element or removable
17 element of the microwave oven. The transducer may be powered
18 from a power source powering the microwave oven. The transducer
19 may be powered by a pulsed impulse function, or driven in a
20 sinusoidal mode and preferably operates at ultrasonic
21 frequencies.

1 BRIEF DESCRIPTION OF THE DRAWINGS

2 These and other features and advantages of the present
3 invention will be better understood in view of the following
4 description of the invention taken together with the drawing(s)
5 wherein:

6 FIG. 1 is a schematic view of the safety device according
7 to the present invention.

8
9 DESCRIPTION OF THE PREFERRED EMBODIMENT

10 Referring now to the drawing wherein like numerals refer to
11 like elements, one sees that FIG. 1 depicts a safety device 10
12 according to the present invention with the safety device
13 designed to be used with a microwave oven 12. The safety device
14 10 generally includes a transducer 14 positioned in a support
15 surface 16 within the microwave oven 12.

16 In operation, the transducer 14 creates a vibrational force
17 of a sufficient amplitude to cause standing waves in the surface
18 18 of a container 20 containing a liquid 22, for example, but
19 not limited to water. The waves generated by the transducer 14
20 create nucleation sites for the liquid 22, thus allowing the
21 liquid to boil. By boiling, a superheated state is avoided for
22 the liquid 22.

23 The support surface 16 of a type known to those skilled in
24 the art within the microwave oven 12 is sufficiently rigid to

1 allow vibrations generated by the transducer 14 to propagate
2 throughout the entire support surface with a negligible decrease
3 in amplitude. The standing waves generated by the transducer 14
4 are of sufficient amplitude to dissipate or shock the liquid 22
5 out of a superheated state. When breaking waves occur on the
6 surface 18, this breaking wave action provides nucleation sites.

7 Standing waves of much less amplitude may be sufficient.
8 High amplitude ultrasonic energy will produce cavitation even
9 under normal conditions. When the liquid is in a metastable
10 state to begin with, the amplitude needed to induce cavitations
11 will be greatly reduced.

12 The transducer 14 may be any device capable of generating a
13 vibrational force sufficient to cause nucleation of the liquid
14 22 within the container 20. The transducer 14 may be powered
15 using a power source (not shown) that powers the microwave oven
16 12.

17 The transducer 14 may operate in several different modes,
18 in that the transducer may create the vibrational force
19 randomly, continuously, or periodically. For example, the
20 transducer 14 may be powered by pulsed impulse functions with
21 sufficient amplitude to shock the liquid 22. Alternatively, the
22 transducer 14 may driven in a sinusoidal mode, but at ultrasonic
23 frequencies, so that the standing waves would have very small
24 wavelengths.

1 The transducer 14 may be activated manually, but is
2 preferably automatically operated once the microwave oven 12 is
3 activated. A timer (not shown) may also be used to activate the
4 transducer 14 after a preset amount of time in the event that
5 the container 20 is left within the microwave oven 12 after the
6 microwave oven has finished heating the liquid 22.

7 In the preferred embodiment, shown in FIG. 1, the
8 transducer 14 is embedded within or secured to the support
9 surface 16. Alternatively, the support surface 16 may be an
10 integral part or a removable element of the microwave oven 12.

11 Accordingly, the safety device 10 creates waves within the
12 liquid 22. The waves create nucleation sites that allow the
13 liquid 22 to safely boil and avoid becoming superheated. The
14 device is easy to operate, thus making the microwave oven 12
15 safer for general use.

16 In light of the above, it is therefore understood that
17 within the scope of the appended claims, the invention may be
18 practiced otherwise than as specifically described.